Deep Learning Project on Image Classification

Group No.*

StudentA StudentB studentC

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Report Table of Contents

1. Introduction

- Project Introduction
- Background and Objectives

Research background and Objectives

❑ Research Background

- The development of computer vision: Deep learning promotes the progress of image classification technology
- Application fields: Target recognition, intelligent monitoring, autonomous driving, etc.
- The significance of campus culture: As an important component of campus culture, campus objects possess unique visual features

❑ Objective

- Build an efficient model: Achieve automatic classification of six types of campus objects
- In-depth understanding of technology: Explore the application of deep learning in image classification through practice
- Innovative approach: Enhance model performance by integrating multiple techniques and strategies

2. Methods and Implementation

- Dataset construction and preprocessing
- Model selection and integration
- Training and Validation

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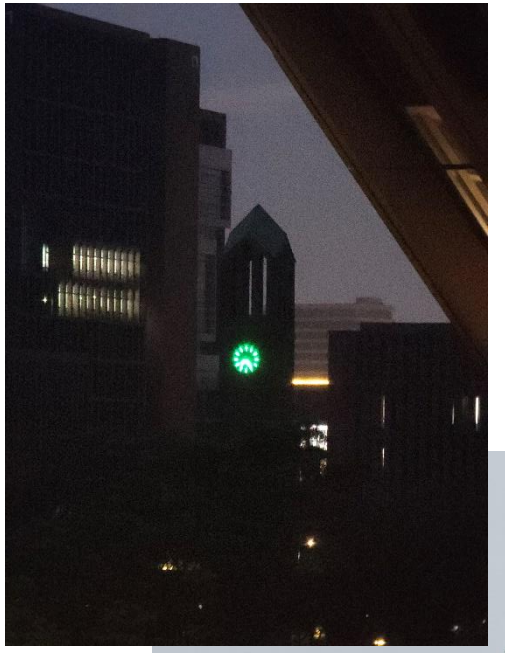
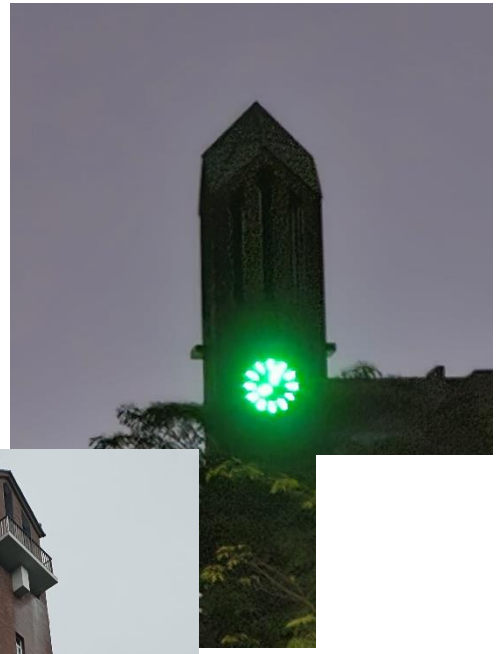
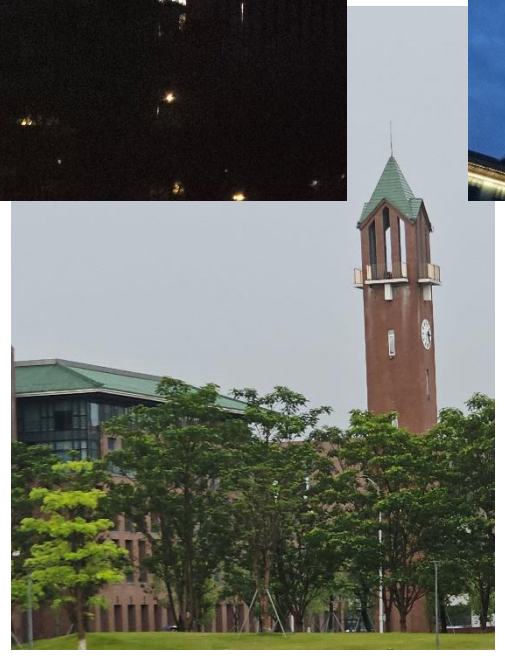
❑ Photo shooting:



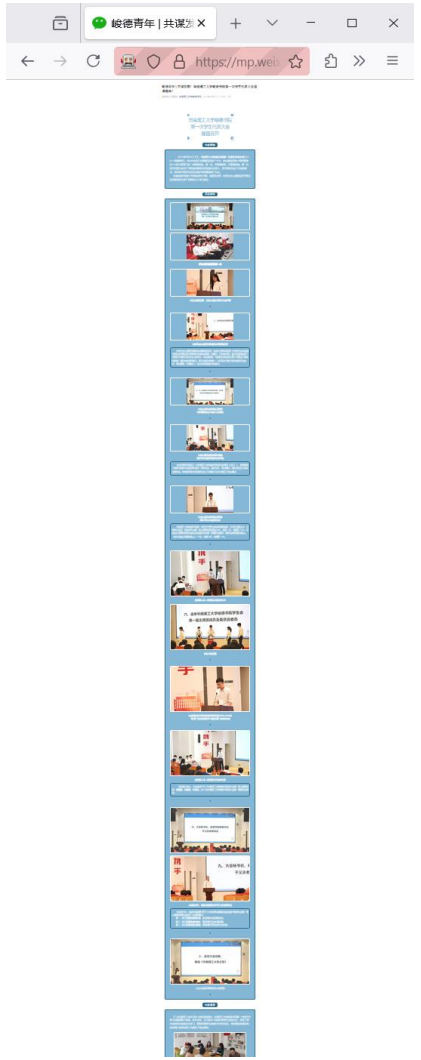




cover different conditions
collected about 2000 pictures

❑ Python Web Scraping + Reqable Packet Capture:

1) Start web packet capture by Reqable.
2) Use python script to browse all of the result of keyword such as “峻德书院” by Sogou Weixin official account article searching.
3) Browsing each article with use python script to detect if all image loaded.
4) After all articles have been accessed, select all image and export the response body.
5) Filter the image with Junde mascot by human.



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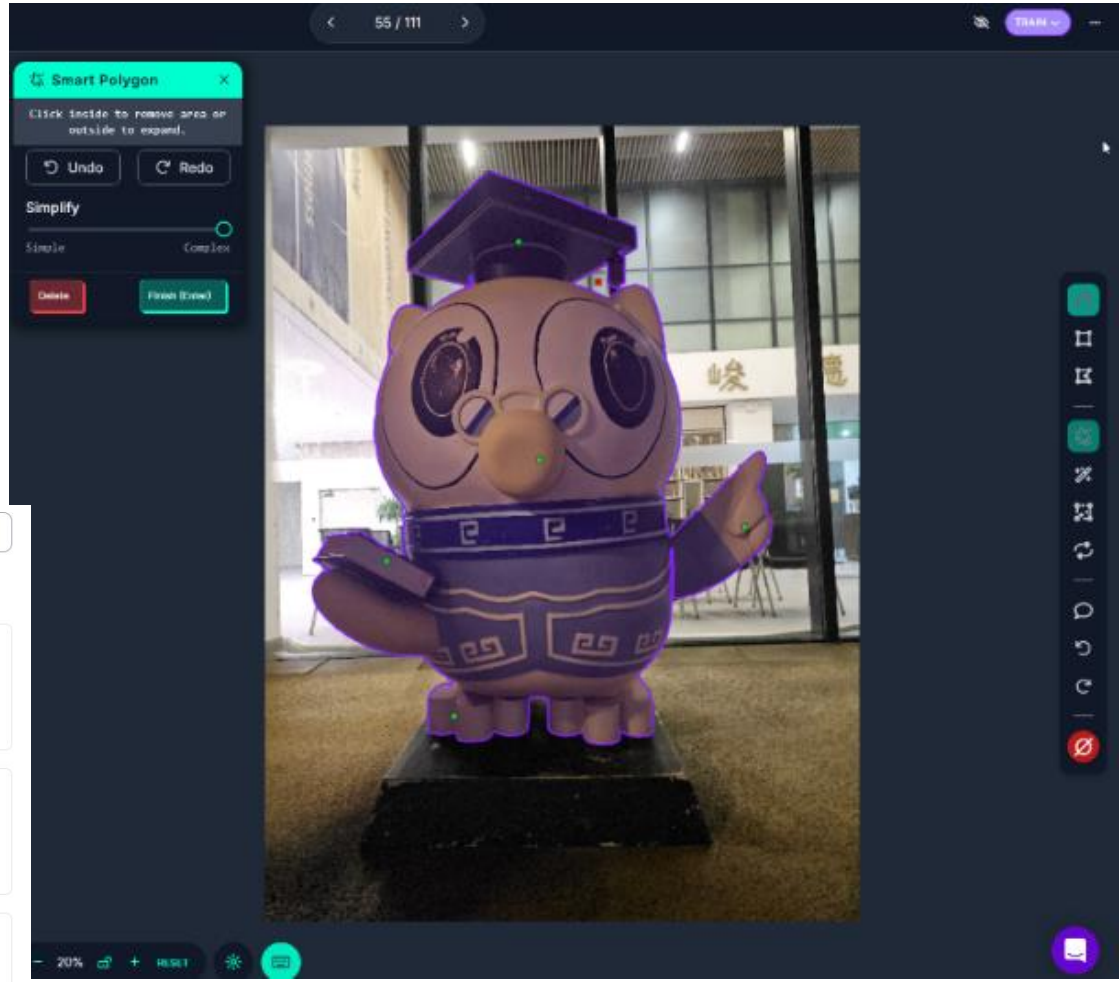
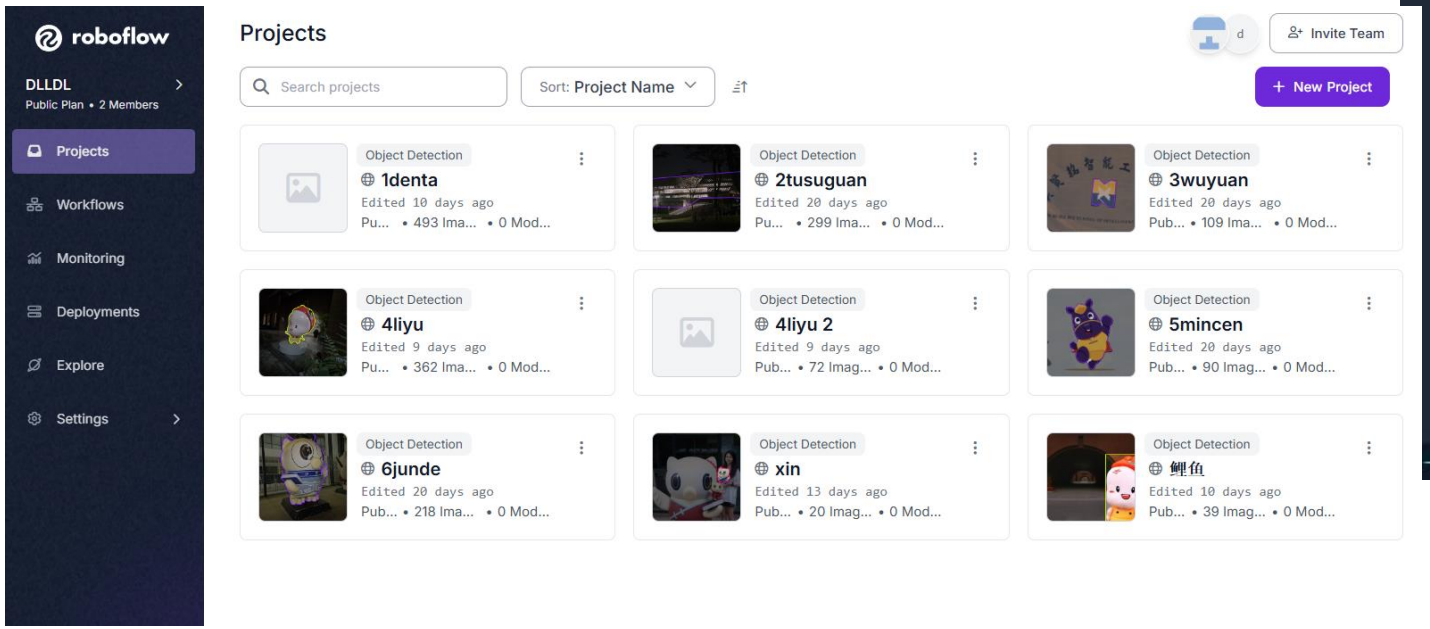
❑ Dataset construction ：

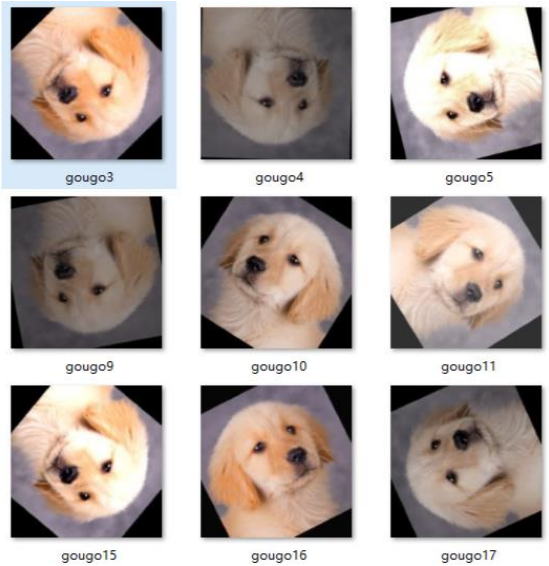
- ➢ Data source
- ➢ Annotation tool
- ➢ Data enhancement

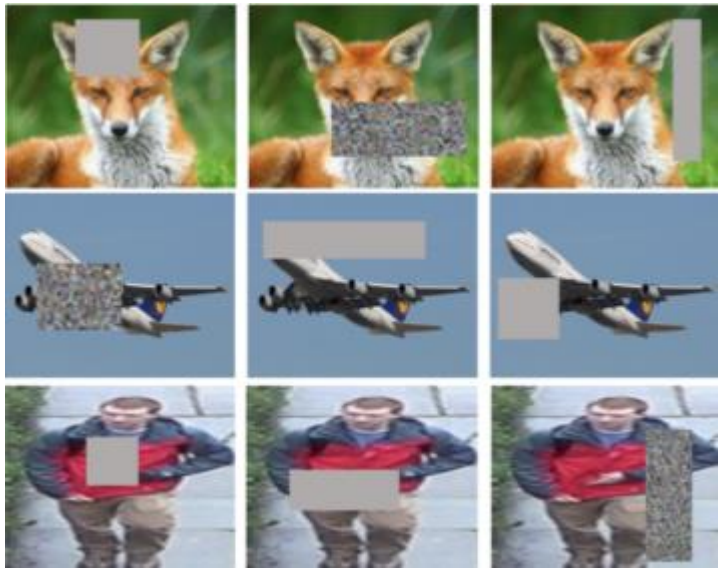




❑ Data preprocessing：

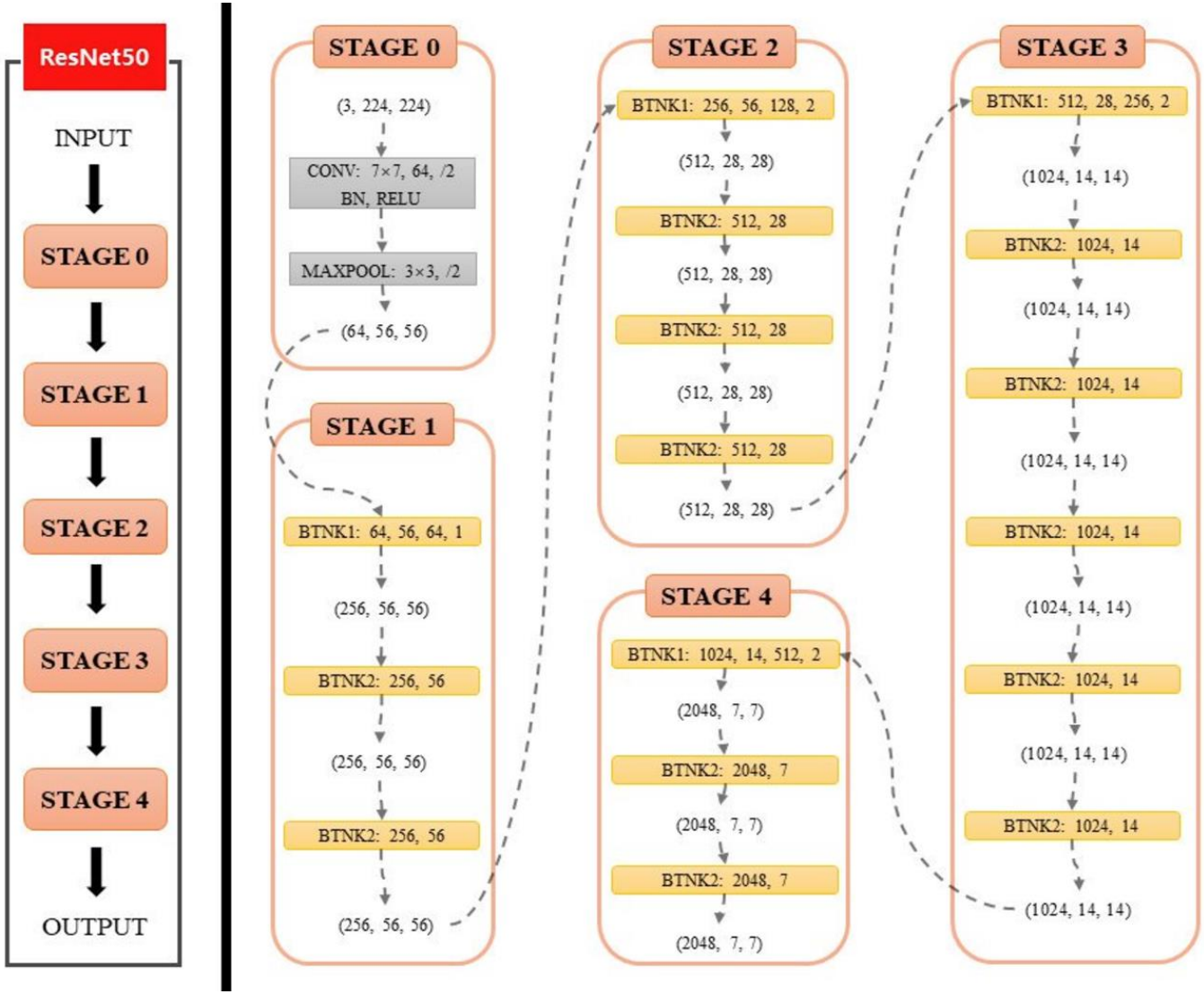
- ➢ Picture adjustment
- ➢ Normalization processing
- ➢ Background removal processing （CustomDataset class）





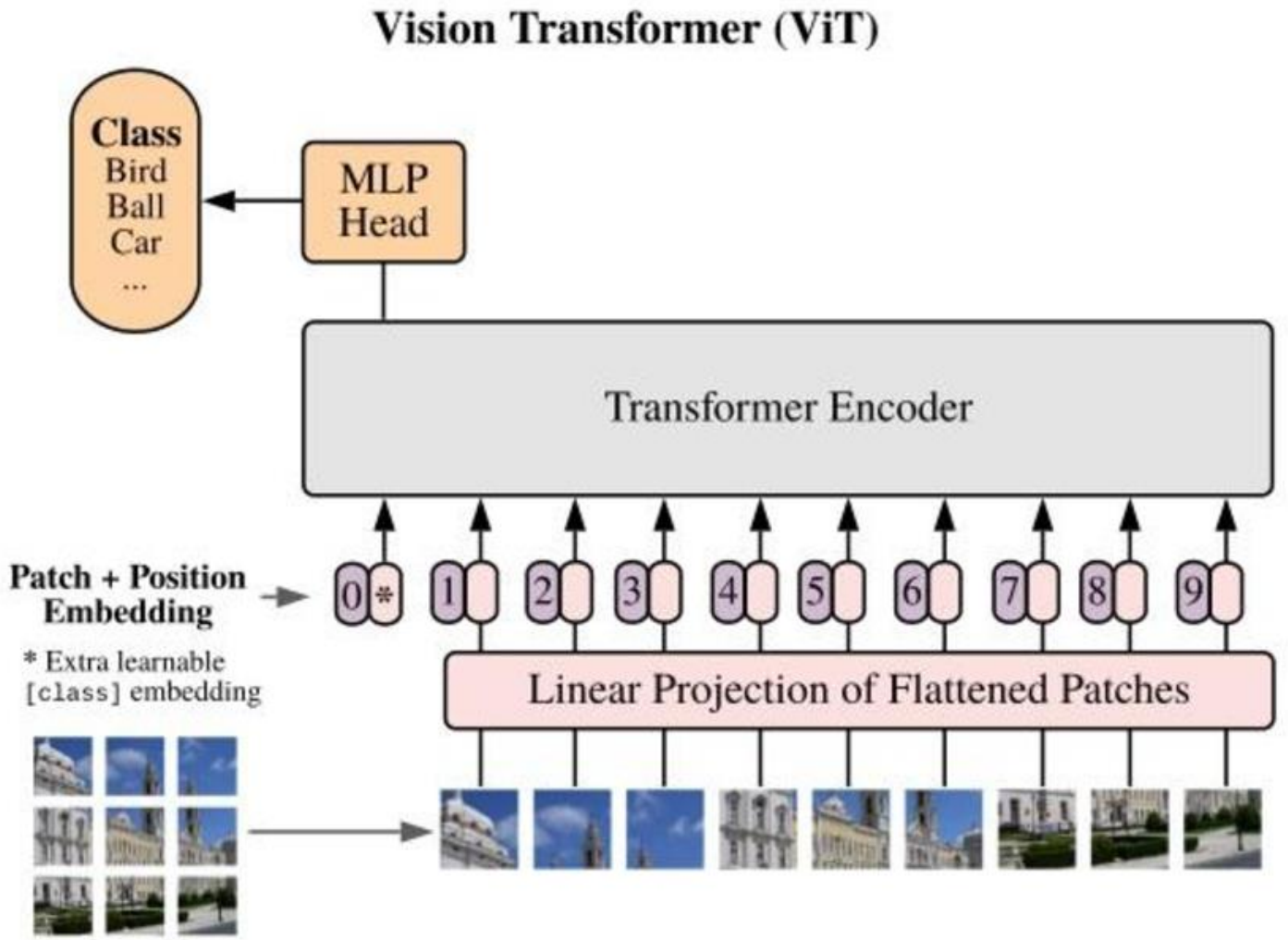
❑ ResNet50

- ➢ Characteristics
- ➢ Advantage



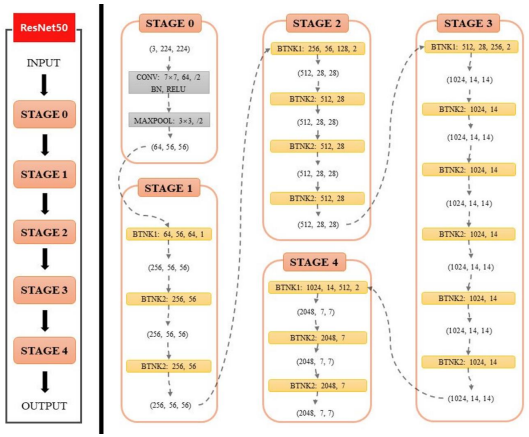
❑ ViT

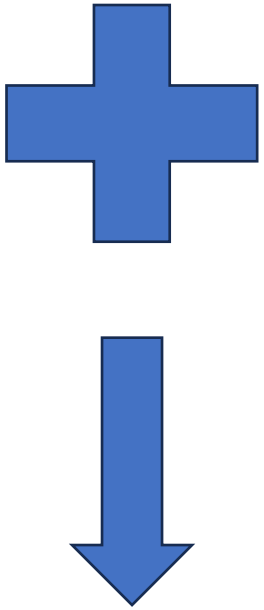
- ➢ Characteristics
- ➢ Advantage

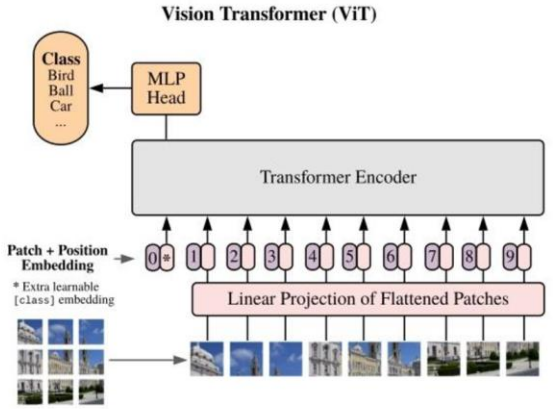


❑ Integrated model joint training

- ➢ reason
- ➢ advantage







ResNet50+ViT Integrated model

❑ Dataset partitioning

- ➢ Allocation

❑ Training process

- ➢ Loss function
- ➢ Optimizer
- ➢ Learning rate scheduling
- ➢ Training stage
- ➢ Verification stage

❑ Model update

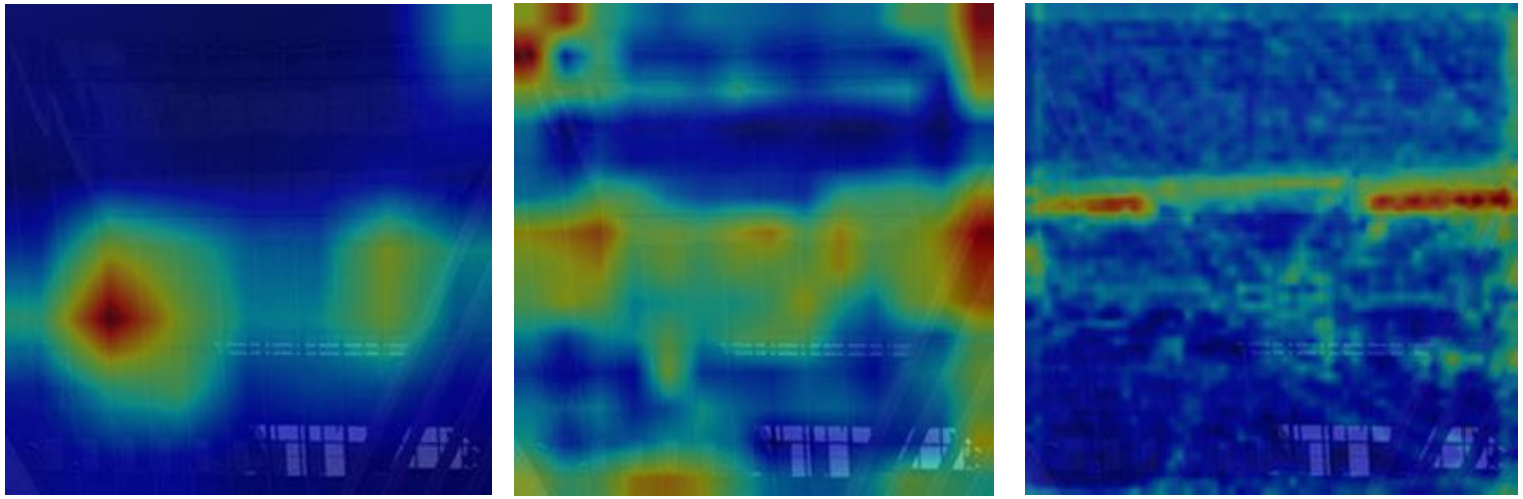
- ➢ Best model preservation
- ➢ Performance monitoring

3. Experiment and Result Analysis

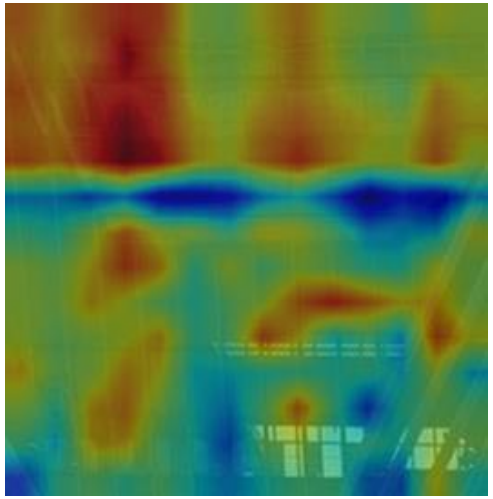
- Experimental verification
- Performance analysis
- Model performance

Feature extraction feature verification

➢ Experiment One: Intermediate Decision-making



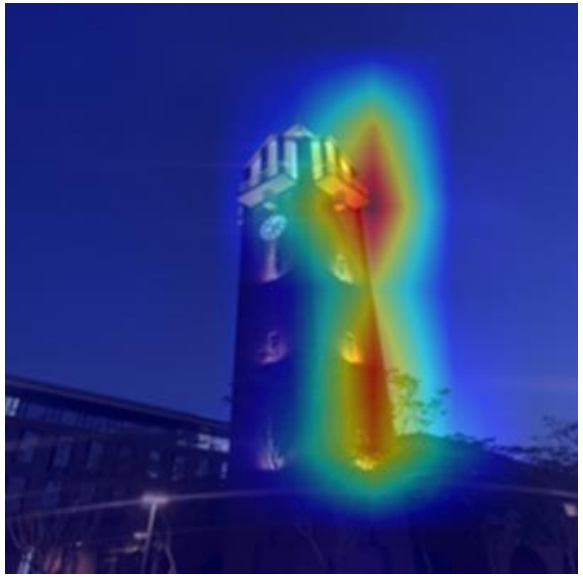
The intermediate feature map of the library by resnet50



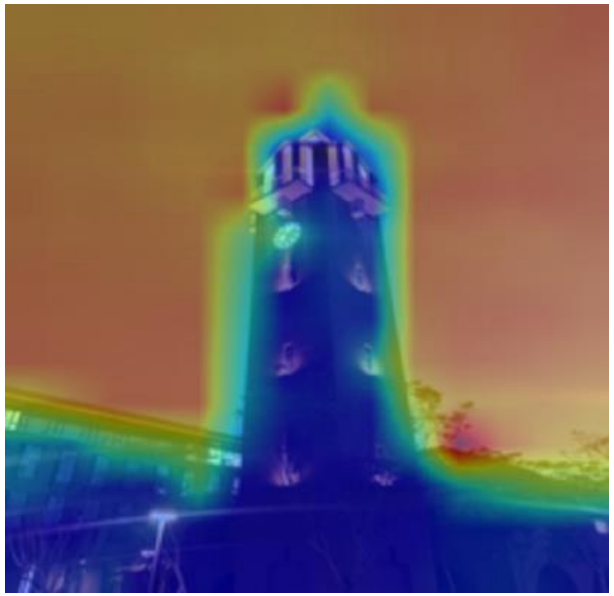
The intermediate feature map of the library by ViT

Feature extraction feature verification

➢ Experiment Two: Final Decision



The final activation diagram of resnet50 for the clock tower



The final activation diagram of the clock tower by ViT

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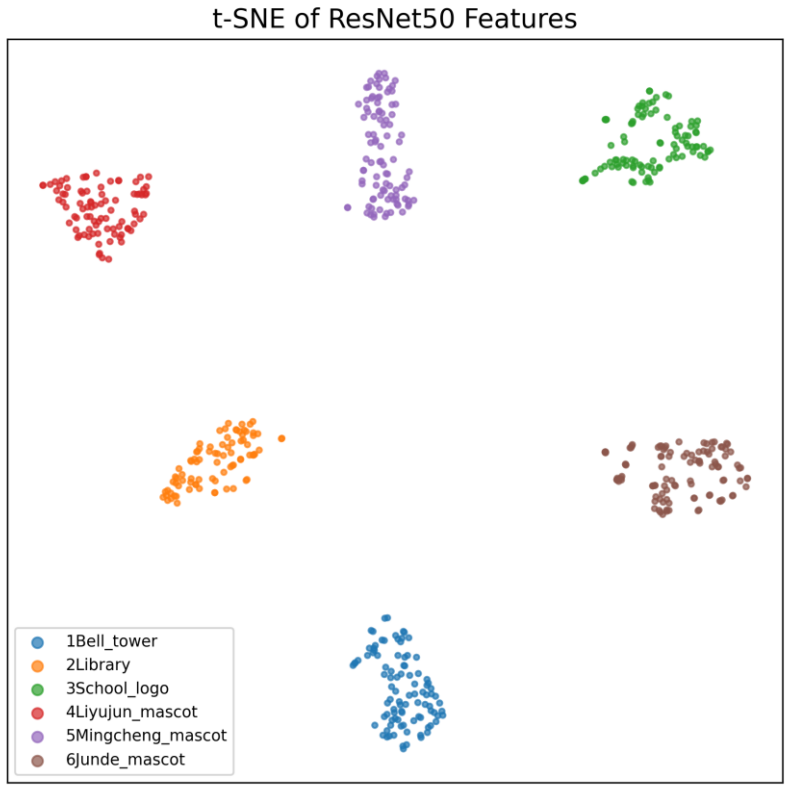
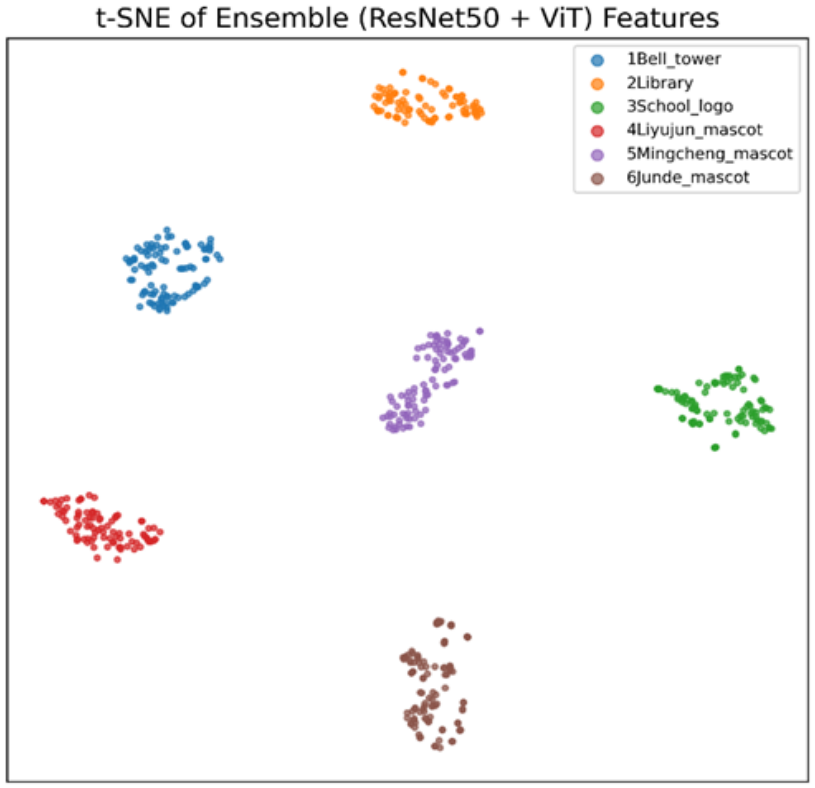
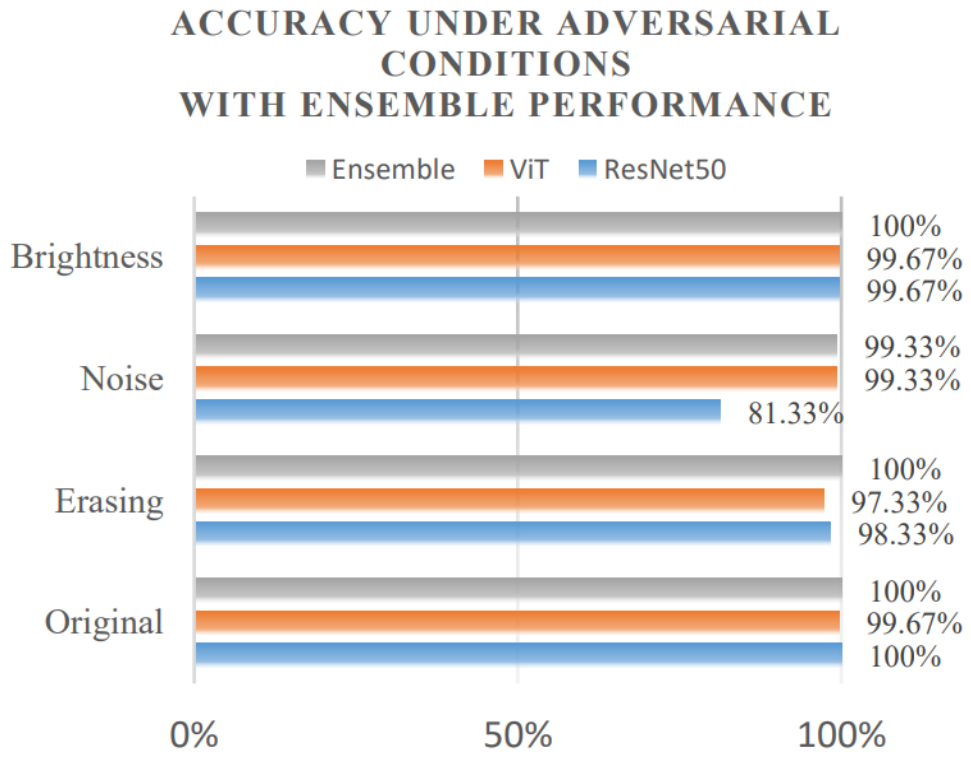
- Experiment 3: Cluster Analysis of Mapping High-dimensional Features to a two-dimensional space





➢ Experiment Four: Robustness Analysis Experiment

Mode	Resnet50 (%)	ViT (%)	Ensemble (%)
Oaring	100	99.67	100
Erasing	98.33	97.33	100
Noise	81.33	99.33	99.33
Brightness	99.67	99.67	100



❑ The advantages of model performance

- ResNet50 single model: Test set accuracy rate 86.67%
- ViT single model: The accuracy of the test set is 83.33%
- Integrated model +TTA: The accuracy rate of the test set is 90%
- Comparative analysis: The integrated model is significantly superior to the single model, and the integrated model has more significant advantages when the data volume of the test set increases, which is attributed to its excellent robustness

4. Innovation Point

- Background removing
- Data enhancement
- Cross-architecture integration
- TTA Strategy
- One-click training
- Optimize data loading

5. Summary

- Key conclusion
- Model decision-making mechanism
- Future optimization path

❑ Key conclusion

- Background removal processing reduces background interference
- Cross-architecture integration enhances performance
- TTA enhances the robustness of the model

❑ Model decision-making mechanism

- Visualize the activation map and feature map
- Cluster analysis verifies the feature extraction ability

❑ Future work

- Introduce more diverse data augmentation technologies
- Explore deeper model fusion methods
- Make use of more efficient training techniques
- The style of the data set has become more diverse

❑ StudentA

- Captured, collected, and annotated approximately 300 images; Drafted the initial Chinese version of the report, created presentation slides and the speech script; Made 1 chart for Report; Presented the content using the slides

❑ StudentB

- Conducted preliminary literature review; Developed data preprocessing scripts (including but not limited to data augmentation and background removal using masks)Built, selected, and trained models; Designed and conducted experiments; Made 9 charts for Report; Assisted in refining the report and presentation slides; Took charge of the presentation and Q&A session

❑ StudentC (repository maintainer)

- Coded a Web Scrap; Shouted , collected and annotated over 1600 photos; Translated, revised and adding content to Report; Made 1 chart for Report; Proofread and added content to PowerPoint ; Edited and adding content to speech script

Thanks